Saguache Solar Energy Project

Wildlife Literature Review

Draft

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Executive Summary

Tetra Tech examined potential adverse effects from the proposed Saguache Solar Energy Project based on the expressed concerns from federal and state wildlife agencies, as well as other concerned groups and the general public. Major categories of concerns included the potential effects to birds from the proposed evaporation ponds, effects to insects from the proposed solar panels, bird collisions with the proposed solar towers, bird mortality from the proposed heliostat/focal point, bat collisions with proposed stationary structures, bird collisions with proposed power lines, construction displacement of birds or other wildlife, the potential creation of a heat island and subsequent disruption of the local ecology, and displacement of a portion of the pronghorn population from the proposed project footprint.

Conclusions reached based on this literature review study are summarized below:

- Although the exact chemical composition of the water in the evaporation pond is not yet known, it is predicted to be a brine solution with a high sodium concentration. Specific effects on birds cannot be accurately predicted at this time, but toxicity to birds is possible. There are methods to deter birds from frequenting the evaporation ponds, such as intermittent rotating beacon or nets.
- Insect mortality has not been specifically studied at heliostats. However, it is unlikely that the heliostats would attract insects as they do not polarize light as photovoltaic panels do, and resultant population declines in birds would not be expected.
- Based on data from communications towers, cooling towers, and smoke stacks; raptor, duck, and crane fatalities have a low probability of occurrence as these birds generally avoid such structures. However, based on literature available, night migrant songbirds are more likely to collide with the proposed project towers. The literature indicates that flashing red lights and the absence of guy wires could help reduce potential bird fatalities.
- Given the patterns of fatalities at the Solar One project in California, it is likely that birds will collide with the proposed project heliostats, and that waterbirds could be more susceptible than other groups of birds. Burning at standby points or focal points could result in low numbers of bird fatalities, with aerial foragers being the most susceptible. However, it is unlikely that such collisions or burning incidents would result in a high number of fatalities because birds would be repelled by the heat generated from these project facilities.
- Based on the available literature, migrating bats might collide with the towers, but the number of fatalities is expected to be very low.
- The proposed project is located outside of the pronghorn winter range and is not located near perennial water sources that would attract pronghorn. Since pronghorn do not generally reside or move through the project area, no effects to pronghorn are indicated.
- Based on the available literature, collision and electrocution at power lines is possible, if the project requires overhead power lines. The proposed project would require a minimum of additional power line interconnection since it would connect with an existing transmission line that traverses the project site. Measures to reduce risk such as building poles to APLIC standards, identifying areas of high use by cranes and waterfowl, and marking lines can reduce fatalities.

- The project is proposed on agricultural land with a history of cultivation, and is therefore, of low value to wildlife. Due to the very limited native habitat that would likely be disturbed, displacement is unlikely to be an issue for wildlife.
- The project does not create heat, but rather uses technology to concentrate solar radiation and uses it to turn a turbine to generate electricity. Therefore, the proposed project would not create a heat island in the valley landscape.

Introduction

Tetra Tech received comments from the US Fish and Wildlife Service, Colorado Division of Wildlife, San Luis Valley Ecosystem Council, and San Luis Valley Renewable Communities Alliance (hereafter groups) expressing concerns about the effects of the Saguache Solar Energy Project (Project) on wildlife. Given there were some nuances in wording, Tetra Tech grouped the comments into major categories, and conducted a literature review to determine if the comments were applicable to the Saguache Solar Energy Project.

Issues of Concern

Evaporation Ponds and Birds

Groups commented that the evaporation ponds could attract birds and the concentration of chemicals in the ponds could be toxic to birds.

Background

Selenium in industrial evaporation ponds is of concern because it bioaccumulates in the aquatic food chain and can cause death and deformity of waterbirds attracted to the pond environment (Ohlendorf et al. 1988, Tanji 2002). Tanner (1999) found that brine shrimp in industrial wastewater ponds in Phoenix, AZ were the primary attractant to birds and that, although the selenium levels in brine shrimp (2 to 10 milligrams/kilogram) were above recommended levels for food chain organisms in aquatic ecosystems, levels were well below those that can cause acute toxicity. The authors concluded that industrial evaporation ponds may not be directly toxic to visiting wildlife but may pose a long-term hazard through the accumulation of selenium in the food chain. In another study, three saline evaporation ponds at a solar facility in the Mojave Desert were compared for differences in the benthic and planktonic communities and algae present and avian visitation and foraging activity (Herbst 2006). The authors concluded that there appeared to be minimal risk associated with selenium poisoning of water birds because selenium was not detected in brine fly larvae or pupae and was found only occasionally in low content in the brine shrimp and corixids and mostly in locales where few birds were found feeding.

Implications for Saguache Solar Energy Project

The water in the evaporation pond is predicted to be a brine solution with a high sodium concentration. However, the exact chemical composition of the water is not known; thus the effects on birds cannot be accurately predicted. However, given the literature on the topic, toxicity to birds is possible. However, if

birds are found to be frequenting the evaporation ponds, they can be deterred by an intermittent rotating beacon or nets (Read 1999).

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Bird Collision with Towers

Groups were concerned that birds would collide with the towers while flying through the area. High concentrations of waterfowl and cranes are found in the San Luis Valley, and the groups were concerned about risk to these types of birds.

Background

Birds collide with anthropogenic features on the landscape during migration (Erickson et al. 2005, Drewitt and Langston 2006). Collisions of birds at communication towers are well documented, and up to several thousand birds have been killed in a single event (Avery 1979, Kerlinger 2000). Wind turbines are also known to cause bird fatalities; however fatality of migrants and other birds at wind turbines is lower than at other structures (Erickson 2005, Kerlinger et al. 2010). Several factors can influence fatality rates at structures including the type of structure and weather during migration. Communications towers equipped with steady burning white lights had higher fatality rates than those with flashing red lights (Ghering et al. 2009), and mortality at communications towers was higher when weather conditions were overcast with a low cloud ceiling (Crawford 1981, Evans et al. 2007). Further, towers with guy wires have higher risk to birds because birds strike the wires while circling towers in flight (Longcore et al. 2008). Less common than communications towers or wind turbines on the landscape are nuclear power plant cooling towers or conventional power “smoke stacks” which can be over 300 feet tall. Mortality at cooling towers was low, numbering less than 300 birds over 7 years (Rybak and Jackson 1973, Temme and Jackson 1979). Mortality numbered over 1,300 birds in a single event at smoke stacks in Florida (Maehr et al. 1983). The mortality occurred during overcast conditions, and the one tower that was lit with white flashing lights had the highest mortality and the tower with red lights had substantially lower mortality. It should be noted that

mortality estimates were not adjusted for scavenger rate or searcher efficiency, so the number presented is the minimum number killed.

Bird mortality at anthropogenic structures varies across taxa. Migrant songbirds comprise the majority of fatalities at communication towers and wind turbines (Erickson et al 2005, Drewitt and Langston 2006, Kerlinger et al. 2010). However, wind turbines tend to result in more raptor fatalities than communications towers. For example, during 3 years of study at a 1,440-foot guyed communications tower in Shawnee County, Kansas, 2,808 individuals of 91 species were found, which included one species of duck (4 individuals), but no raptors and no cranes. Similar results of communication tower studies can be found across the country (Kemper 1996, Crawford and Engstrom 2001). The discrepancy between the number of fatalities of raptors at communication towers and wind turbines is likely the result of the diurnal behavior of raptors enabling them to avoid the towers, but not the spinning turbines when hunting (Madders and Whitfield 2006, Smallwood et al. 2009). The number of waterfowl and other wading birds found at wind farms and communications towers is similarly low, suggesting that these taxa avoid structures (Crawford and Engstrom 2001, Erickson et al. 2004, Anderson et al. 2005, Jain et al. 2007).

Implications for Saguache Solar Energy Project

Given the patterns of fatalities at tall structures, birds - in particular night migrant songbirds, are likely to collide with the towers at the Saguache Solar Energy Project. Flashing red lights and the absence of guy wires could help reduce fatalities, and the number of fatalities will also be based on the frequency of adverse weather events during migration and the number of migrants moving through the area. Based on data from communications towers, cooling towers, and smoke stacks, raptor, duck, and crane fatalities are unlikely to occur.

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Bird Collisions with Power Lines

Groups were concerned that birds, especially cranes, would collide with power lines associated with project development.

Background

Electrocution of birds by power lines is well documented (Boeker and Nickerson 1975, Bevanger 1998, Harness and Wilson 2001, Drewitt and Langston 2006). Birds are electrocuted at power lines because they touch energized structures and complete a circuit. Because of the design, distribution lines that deliver electricity at 69 kV or lower to individual users result in more electrocutions than transmission lines that are energized at 115 kV or greater (Lehman 2001). Raptors are particularly susceptible to electrocution because they often land on power poles or lines, and may attempt to nest on energized structures (APLIC 2006, Lehman et al. 2010). Building distribution poles to APLIC standards or retrofitting existing poles can reduce electrocution fatalities of raptors (Lehman et al. 2010)

Similarly, collision by birds with power lines is widely recognized as a source of mortality in several species (Erickson et al. 2005, Drewitt and Langston 2008). Sandhill cranes and whooping cranes are susceptible to collision mortality with power lines, presumably due to their poor maneuverability while in flight (Stehn and Wassenich 2008, Jekins et al. 2010). Distribution lines located neared foraging or roosting areas can have high rates of crane fatalities because of individuals approaching or departing the area are flying at low altitudes and might not be able to avoid the line (Drewitt and Langston 2008). Further, fatalities can occur when a flock is flushed from the roost after dusk near a distribution line (Murphy et al. 2009). Previous assessments based on carcass searches indicate that marking power lines with bird diverters can reduce mortality by roughly half (Morkill and Anderson 1991, Brown and Driewen 1995). A study on the effectiveness of power line marking was conducted in the San Luis Valley near the Note Vista National Wildlife Refuge in Colorado (Brown and Drewien 1995). From 1988 – 1991, 90 sandhill cranes, 391 ducks and geese, and 105 other birds, which included 8 raptors, were found dead beneath 13.2 km of marked and unmarked power lines.

Implications for Saguache Solar Energy Project

Based on the available literature, collision and electrocution at power lines is possible, if the project requires overhead power lines. The proposed project would require a minimum of additional power line interconnection since it would connect with an existing transmission line that traverses the project site. Measures to reduce risk such as building poles to APLIC standards, identifying areas of high use by cranes and waterfowl, and marking lines can reduce fatalities.

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Bird Mortality from Heliostats and Focal Points

In addition to collision with the towers, groups were that bird fatalities would occur at the focal point where birds would be burned and from collisions with heliostats.

Background

There have been concerns expressed about the impacts of solar heliostats and focal points on avian populations. A study at the Solar One solar energy power plant in the Mojave Desert, in San Bernardino County, California was conducted to determine the impact of bird mortality on local populations (McCrary 1986). Two causes of avian mortality were identified, collision with structures and burning at standby points. From the location of birds in relation to structures, most (>75 percent) died from colliding with the heliostats; 19 percent of the birds died from burning in the standby points. Of the burn fatalities, 46 percent were aerial foragers (swifts and swallows). Avian mortality was considered an insignificant impact of the solar plant to location populations. The estimated rate of mortality (1.9-2.2 birds per week) resulted in only 0.6-0.7 percent of the local population that may have been affected. It was suggested that the mortality at the facility was a result of the location of the evaporation pond that attracted birds in the desert environment.

Implications for Saguache Solar Energy Project

Given the patterns of fatalities the Solar One project in California, it is likely that birds will collide with the heliostats at Saguache Solar Energy Project. If waterbirds are present in the area, they could be more susceptible to collisions with heliostats than other groups of birds. Water is more abundant in the San Luis Valley than in the Mojave Desert, and thus the Saguache Solar Energy Project might not be as attractive to waterbirds as Solar One Project. Burning at standby points or focal points could result in low numbers of fatalities, with aerial foragers being the most susceptible. However, it is not anticipated that

collision with the heliostats or burning at the standby or focal points will result in high number of fatalities because birds would be repelled by the heat.

Literature Cited

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Bat Collisions with Stationary Structures

Groups were concerned that bats could collide with the receiver tower.

Background

Before the more recent studies of bat mortality at wind farms, early studies have documented bat collisions with man-made structures, such as lighthouses, communication and television towers and tall buildings (Van Gelder 1956, Crawford 1981). Bats avoid structures and capture prey by using echolocation (Fenton 2004). However, bats are known to use visual cues when moving through unobstructed environments (Orbach and Fenton 2010). Various studies have indicated that bats may collide with objects more frequently if using vision, which may be less reliable than echolocation in some settings, and the frequency of collision may depend on the lighting conditions (McGuire et al 2010, Orbach 2010). Thus, if bats use vision during migration and rely less on echolocation, they could collide with stationary structures. However, the low number of collisions with stationary structures reported in the literature suggests that bats regularly avoid such collisions.

Implications for Saguache Solar Energy Project

Based on the available literature, migrating bats might collide with the towers, but the number of fatalities is expected to be very low.

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Insects Attracted to Solar Panels

Groups commented that the solar panels could attract insects and lead to insect population decline, which would have a cascading effect to bird populations.

Background

Polarotactic aquatic insects (insects that oviposit in water) are attracted to horizontally polarizing man-made surfaces because the polarized surface appears as water (Malik et al. 2008). Insect mortality has been documented as well as breeding failure, and the potential subsequent decline in bird populations has been suggested at large photovoltaic projects (Horvath et al. 2010).

Implications for Saguache Solar Energy Project

Insect mortality due to attraction has not been studied at heliostats. It is unlikely that the heliostats would attract insects as they do not polarize light as photovoltaic panels do, and resultant population declines in birds would not be expected.

Literature Cited

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Project Could Displace Pronghorn

Groups stated that the area is used by pronghorn and that development of the project would displace pronghorn.

Background

Development of natural habitats can displace ungulates (Morrison et al. 1995, Rowland et al. 2000, Sawyer et al. 2006). In Colorado, pronghorn are found primarily on the eastern plains and can also be found in mountain valleys, and shrublands west of the mountains. Pronghorn in the San Luis Valley are in data analysis unit (DAU) PH-14, which merged DAU A14, DAU A15, and DAU A24 (CDOW 2008). The San Luis Valley DAU (DAU) is comprised of both private and public land, and includes agricultural and forest habitat; the DAU covers a total of 3,226 square miles of which 1,506 square miles is overall pronghorn range (CDOW 2008). During winter, pronghorn move to lower elevations and south facing slopes. Pronghorn are found in the highest in the area along San Luis Creek near Villa Grove. The population in the DAU is approximately 2000 individuals in 2008, and is decreasing overall, but increasing in some areas (CDOW 2008).

A main limiting factor of pronghorn in the San Luis Valley is lack of water. A drought from 2001 to 2003 resulted in low reproduction and recruitment in the DAU (CDOW 2008). Given the limited water in the DAU, pronghorn have moved to irrigated alfalfa fields on private land where they can cause damage to crops. Development of private lands is a growing problem in the DAU, especially in GMU 79. Impacts to

the pronghorn population from development could include loss of important limited habitat, displacement of animals from historic winter range, and migration and movement barriers created by roads and fences.

Implications for Saguache Solar Energy Project

The proposed project is proposed to be developed on existing agricultural land, specifically used for potato farming. The proposed project is outside of the winter range and not located near perennial water sources. Thus, the proposed project is unlikely to displace pronghorn as pronghorn are unlikely to occur in the project site area.

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Construction Displacement of Birds or Other Wildlife

Groups were concerned that the development of the Project would result in habitat loss and displace wildlife.

Loss of habitat results in the displacement of animals. However, the project is proposed on agricultural cultivated land, which is of low value to wildlife. Thus, as limited native habitat will be disturbed, displacement is unlikely to be an issue for wildlife.

Project Could Create Heat Island

Groups were concerned that the development of the Project would create a heat island and cause subsequent disruption of the local ecology.

The project does not create heat, but rather uses technology to concentrate solar radiation and use it to turn a turbine to generate electricity. Therefore, the proposed project would not create a heat island in the valley landscape.